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A Small-Scale Forestry Perspective on Constraints to Including REDD in International Carbon Markets

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Abstract In this article the authors contend that the constraints to including reduced emissions from avoided tropical forest deforestation and degradation in international carbon markets stem from problems associated with: (1) correctly measuring emissions savings from avoided tropical forest deforestation and degradation; (2) the permanence and 'leakage' of tropical forest conservation regimes; (3) ensuring economic incentives for the avoidance of tropical forest deforestation and degradation are sufficiently effective; (4) the exclusion of reduced emissions from avoided tropical forest deforestation and degradation from critical international climate change policy agreements; and (5) the behaviour of investors in carbon markets. Case analysis of the 'Emissions Biodiversity Exchange Project for the 21st Century' (EBEX21) program of Landcare Research New Zealand is used to examine how a government-supported market-based forest conservation initiative can be used to address these constraints, particularly in the context of small-scale forestry conservation.

Keywords Carbon offsets · Voluntary carbon markets · Climate change · Forest protection · Emissions trading

Introduction

Policy-makers and stakeholders interested in maintaining the carbon storage within tropical forests are faced with two major concerns—*deforestation* and forest

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degradation. Deforestation[1] refers to the conversion of forest to another land use, usually agriculture, and typically involves release of greenhouse gases (GHGs) from both loss of biomass (upper and below ground) and disturbance of the soil, dead wood and litter. Forests typically hold much more carbon per unit area than other types of vegetation (Houghton 2007), thus land-use conversion to agriculture involves a net loss of carbon. Forest degradation refers to changes within a forest which negatively affect the structure or function of the forest, and its GHG storage capacity (FAO 2006b).[2] Forest degradation practices include unsustainable commercial logging and over-harvesting of fuelwood (Essama-Nssah and Gockowski 2000), and degradation is commonly a precursor to deforestation (DeFries et al. 2007; Angelsen 2008a, b; Dutschke and Pistorius 2008).

Estimates of emissions attributable to deforestation and forest degradation have ranged from 6 to 28% of total global anthropogenic carbon emissions (Persson and Azar 2007). The most recent Intergovernmental Panel on Climate Change Report (IPCC 2007) estimated that of the 49 Gt carbon dioxide equivalent of anthropogenic GHG emissions in 2004, 17.3% was attributable to carbon dioxide from deforestation, forest degradation, decay of biomass associated with land-use change of forested land and forest harvesting operations. Notably, these estimates assume a global deforestation rate of 13 M ha per year, predominantly of forests in the tropics (FAO 2006a). It is generally anticipated that such high rates of deforestation and forest degradation are likely to continue, with tropical deforestation expected to be responsible for between 9 and 22% of the increase in atmospheric carbon dioxide by the end of this century (Persson and Azar 2007). Moreover, proponents of initiatives to include reduced deforestation and forest degradation in international climate change agreements claim that a 50% reduction in the rate of deforestation around the globe by 2050 and the maintenance of this deforestation rate until 2100 would avoid the release of 50 Gt of carbon (Gullison et al. 2007). This is equivalent to nearly 6 years of recent global annual fossil fuel emissions (Gullison et al. 2007).

It is not surprising that the international debate on the role of forests as a means of reducing GHG emissions has been at times contentious and pivotal in intergovernmental climate change negotiations. Initially focused only on avoided deforestation, the debate has expanded to include aspects of forest degradation, conservation, enhancement carbon stock and sustainable management (REDD+),

[1] Decision 11 of COP7, paragraph A1, defines a forest as 'a minimum area of land of 0.05–1.0 hectares with tree crown cover (or equivalent stocking level) of more than 10–30 per cent with trees with the potential to reach a minimum height of 2–5 m at maturity in situ···'. This forest definition is often called the Kyoto Forest Definition. It also defines deforestation as 'the direct human-induced conversion of forested land to non-forested land'. Paragraph E16 requires each Annex 1 country to select the minimum tree cover area and height applicable to that country and justify that selection. Decision 19 of COP9 has a similar requirement in relation to countries within which CDM projects are located. Up to COP 15, there has been no decision on the forest and deforestation definitions to be applied for REDD+ implementation.

[2] In relation to climate change mitigation efforts from forests in the Kyoto Protocol, IPCC (2003) defined forest degradation as 'A direct human-induced long-term loss (persisting for *X* years or more) of at least Y% of forest carbon stocks[and forest values] since time T and not qualifying as deforestation or an elected activity under Article 3.4 of the Kyoto Protocol···' IPCC acknowledged that there is no solid definition for Kyoto forest degradation as current available definitions cannot accommodate criteria required.

and how these activities can be included in so-called 'carbon markets'. This paper contributes to the debate in two ways. First, a framework is presented to conceptualize the constraints on including tropical forest REDD+ in carbon markets. Second, a case analysis is presented of the 'Emissions Biodiversity Exchange Project for the 21st Century' (EBEX21) program of Landcare Research New Zealand, to examine how a government-supported market-based forest conservation initiative can be used to address a number of these constraints, particularly from the perspective of small-scale forestry.

Defining Carbon Markets

Carbon markets are defined in this paper as *markets in which GHG emissions offsets or savings are bought and sold*. In this context, carbon markets are considered as a sub-set of environmental markets at-large, as discussed by Dargusch and Griffiths (2006). Carbon markets are considered as predominantly an artifact of the international climate change policy initiatives of the United Nation's Framework Convention on Climate Change's (UNFCCC) Conference of Parties since 1995 to present (COP1—COP15). Arguably the most influential of these agreements in relation to the development of market-based approaches to mitigating climate change has been the Kyoto Protocol of COP 3. The authors acknowledge that a number of additional complex phenomena influence the nature and state of carbon markets. These include:entrepreneurship (Beveridge and Guy 2005; Weerawardena and Sullivan Mort 2006); corporate governance processes regarding risk management, obligations to stakeholders and competitive strategy (Gunningham et al. 2005; Smith 2005; Benn et al. 2006); and consumer demand for sustainably produced products and services.

It is also important to recognize the major distinction that the Kyoto Protocol makes between the rules of carbon markets in developed countries and those in developing countries and how that distinction makes for two vastly different carbon market contexts. Most tropical forests are located in developing countries, so in this paper the authors view carbon markets from the perspective of proponents of REDD+ in developing countries. Critically, REDD+ in developing countries is not specifically incorporated in any of the Kyoto Protocol provisions related to carbon markets, so it is also important to recognize that many of the issues in the debate about the inclusion of REDD + in carbon markets stem from this current policy impasse.

Carbon markets can be broadly classified as regulatory markets and voluntary markets. Regulatory carbon markets are those markets regulated by international, national or regional government policies and law. Although there are a number of regulatory markets that allow trading of carbon offset credits between parties in developed countries, none of these offset credits from REDD projects in developing countries.[3] The Kyoto Protocol has also given rise to two other types of regulatory

[3] The New South Wales Greenhouse Gas Abatement Scheme recognizes offset credits from avoided deforestation, although this is limited to avoided deforestation projects located in New South Wales (Bayon et al. 2007).

carbon markets, namely the Clean Development Mechanism (CDM) (defined in Article 12 of the Kyoto Protocol) market, and the Joint Implementation Mechanism (JI) (defined in Article 6 of the Kyoto Protocol) market. The CDM market allows public and private entities in developed countries to meet their emissions reductions obligations under the Kyoto Protocol by investing in 'sustainable development' projects in developing countries. The investment mechanism is the trading of Certified Emission Reductions (CERs) representing GHG offsets. Within the forest sector, only afforestation and reforestation activities qualify for the CDM. Joint Implementation is similar to CDM, although it pertains to projects in developed and 'in-transition' countries (Humphreys 2008).

Afforestation and reforestation CDM projects have been slow to materialize. As of February 2010, only 14 afforestation and reforestation CDM projects had been approved since the commencement of the market (UNFCCC website 2010). These registered afforestation and reforestation projects are only 0.52% of total CDM registered projects. There are two main reasons for this slow uptake of forestry-related projects in regulated carbon markets. One reason relates to the complexity of the rules related to the markets. UNFCCC rules related to afforestation and reforestation CDM, due to their technical complexity, took 2 years longer to negotiate than in other sectors including energy (FAO 2008). Once established, the rules were found too complex for small-scale projects and simplified rules and procedures for small-scale projects in low-income communities were only recently approved. In February 2010, the Executive Board of CDM had only approved 16 afforestation and reforestation methodologies, including six methodologies for small scale projects. The other reason relates to the relatively high transaction costs of afforestation and reforestation CDM projects (as discussed by Cacho et al. (2005), Cacho and Lipper (2007) and FAO (2008). In the regulatory carbon market, demand is regulation-driven and the participants are primarily concerned with the least-cost means of meeting their allowances. Therefore the lowest cost offset projects—which are most frequently not afforestation and reforestation CDM projects—tend to dominate the market (Humphreys 2008).

Voluntary carbon markets include a global over-the-counter (OTC) market for carbon offsets and a number of voluntary exchange forums, most notably the Chicago Climate Exchange (CCX). Although the CCX is a voluntary market, it is subject to self-imposed rules in the form of a cap on emissions, allocation of emissions that are tradable and permitted offsets. As a consequence, CCX credits tend to be more commoditized and the market tends to operate in a way more akin to regulatory markets. The flexibility offered by the voluntary carbon market offers two main advantages over regulatory carbon markets, namely lower transaction costs and absence of pre-approval requirements (such as the need for Designated National Authority approval under the CDM rules). These features provide particular advantages for small-scale projects. For example, establishment of CDM carbon offset projects must be approved by the UNFCCC's CDM Executive Board, a time consuming and costly process. The costs of this approval process can range from US$50,000 to US$250,000. The total upfront costs of a small-scale CDM project have been estimated to account for between 14 and 22% of the net present value of the project. In 2007, voluntary transactions for all sectors grew by 165%,

but despite this impressive growth the voluntary carbon market remains only a small fraction (about 2.2% volume-wise) of the size of the regulatory carbon market, which in 2007 transacted over 2,959 Mt of carbon dioxide equivalent, valued at over US$66,421 million (Capoor and Ambrosi 2008).

Constraints on Including REDD+ in the Tropics in Carbon Markets

It is contended in this paper that the constraints to including reduced emissions from avoided tropical deforestation, forest degradation, forest conservation, sustainable management of forest and increased carbon stock, in international carbon markets stem from issues and problems associated with:

(1) correctly measuring net emissions from REDD+;
(2) the permanence and 'leakage' of carbon emissions from tropical forest activities;
(3) ensuring economic incentives and payment distribution for REDD+ are sufficiently effective;
(4) the fact that REDD+ is not accepted in international climate change policy agreements; and
(5) the behaviour of investors in carbon markets.

In discussing these types of constraints, the authors acknowledge that many of the different types of constraints influence each other and have various features in common.

Correctly Measuring Emissions Savings

To demonstrate verifiable carbon benefits, REDD+ projects must design and implement:

(1) an initial carbon inventory;
(2) a baseline (which is a business as usual scenario for future forecast emissions) and reference level (emission reduction scenario to be achieved under the REDD+ scheme);
(3) continuing carbon monitoring; and
(4) a transparent sequestration verification program.

One of the major challenges for REDD+ projects in developing countries in the tropics is the lack of information and processes for collecting data in relation to GHG emissions from forest changes. The established process to obtain this information at a national level (currently primarily for policy and decision-making) is through field-based forest inventories and remote sensing (FAO 2006b). Whilst this inventory practice is well established in developed countries, many developing countries lack resources and institutional capacity (FAO 2006b) and therefore tend not to have the necessary data for assessing the carbon storage value and leakage without further assessment.

This limitation extends to a lack of efficient monitoring and verification capacity. Monitoring and enforcement are costly and measurement of carbon sequestration is often complex, particularly with respect to assessments of soil organic carbon (van Kooten and Sohngen 2007). A trade-off occurs between greater accuracy in emission assessments and the costs of measuring and monitoring carbon sequestration. Greater accuracy may involve the use of more complex models and rules. This may create greater scope for manipulation and lead to higher costs of participation in carbon markets, which in turn may lead to lower participation and lower efficiency of the market in reducing emissions (Karsenty 2008). Recent discussions held by the Subsidiary Body on Scientific and Technological Advice (SBSTA) at COP15 resulted in a draft UNFCCC decision allowing developing countries the opportunity to develop their own country-specific methodology based on their respective capabilities and circumstances (SBSTA 2010, FCCC/SBSTA/2009/L.19/Add.1).

Permanence and 'Leakage' of Carbon Emissions in Tropical Forest Conservation Regimes

Permanence of carbon sequestration can be reduced as a result of natural disturbances such as fires. Permanence can also be threatened by the lack of reliable guarantees that the original deforestation and forest degradation activities and the associated emissions will not return (Brown et al. 2000). Many developing countries in the tropics lack resources to implement and monitor policies, and may also have a high degree of political instability, and these characteristics increase the risk that a project will not be permanent.

A number of strategies have been identified to guard against such reversals, including:

(1) establishing contingency carbon offsets—offsets that are kept in reserve and provided as a form of insurance if needed (Brown et al. 2000);
(2) establishing partial instead of full credits for stored carbon, discounted according to the perceived risk to permanence (van Kooten and Sohngen 2007);
(3) insurance by the buyer or seller where the insurer will substitute credits from another carbon sink at the time of default or the occurrence of fire (van Kooten and Sohngen 2007); and
(4) use a rental system for sequestered carbon, where credits are leased for a finite term (Marland et al. 2001).

Apart from insurance, these strategies involve progressive payments for credits arising from continued conservation.

Leakage is the risk that a REDD+ project would simply lead to increased deforestation outside the project's boundary, thereby displacing rather than reducing deforestation (Brown et al. 2000; Aukland et al. 2003; Persson and Azar 2007). REDD+ projects are particularly prone to leakage because they typically involve the discontinuation or avoidance of an economic activity. If no alternative livelihood option is provided to the agents of that activity, there may simply be direct displacement of activities to another location (Aukland et al. 2003).

The challenges related to leakage are how to design a project to minimize leakage, how to quantify any leakage that does occur, and how to monitor possible leakage. Leakage can be anticipated and accounted for (Humphreys 2008), and it can also be controlled as part of the project design by addressing the demands for products or resources (such as fuelwood) (Brown et al. 2000; Humphreys 2008). Leakage was prominent among the concerns of environmental advocacy groups in relation to including forest carbon sequestration in the CDM provisions of the Kyoto Protocol (Murray et al. 2004; Angelsen 2008a, b).

Ensuring Economic Incentives and Payment Distribution are Sufficiently Effective

A major challenge for REDD+ projects is how to ensure that sufficient economic incentives for reducing emission are paid to firms and populations adjacent to forested land who often act as agents of deforestation and forest degradation (Persson and Azar 2007). In many cases, communities located close to tropical forests have a tradition of living off the forest resources or have grown accustomed to the revenue earned from forest harvesting. If REDD+ projects restrict access to these forests, the projects must incorporate payments to local communities or create alternative means for those communities to address their livelihood needs over the term of the REDD+ project. A lack of success in designing and implementing these projects will substantially increase the risk of lack of permanence and of leakage (Brown et al. 2000).

Exclusion From International Climate Change Policy Agreements

The Kyoto Protocol rules currently take account of deforestation and degradation (and therefore also avoided deforestation and degradation) only in that it is included in the calculation of annual net GHG emission levels of Annex I countries (i.e. developed countries). Avoided deforestation and degradation was however excluded from the flexibility mechanisms, most notably the CDM, hence avoided deforestation and degradation in developing countries essentially has no value under the Kyoto Protocol. Exclusion of avoiding deforestation and forest degradation from the CDM of the Kyoto Protocol continues to be a highly contentious decision. This is not only because of the magnitude of potential benefits from avoiding deforestation and forest degradation, but also because forestry is a major resource for many developing countries, and the exclusion of avoiding deforestation and forest degradation therefore has a substantial impact on the priority given by developing countries to forests and climate change.

There are various reasons why avoiding deforestation and forest degradation has been excluded from the Kyoto Protocol's first commitment period. These reasons relate to concerns about:

(1) whether carbon emitters could use forestry-based offsets as a way to avoid making the necessary reductions to their energy-related emissions (Totten et al. 2003);

(2) whether rules to prevent leakage, achieve permanence and achieve 'additionality' could be adequately adhered to by smaller-scale avoiding deforestation and forest degradation projects (Persson and Azar 2007);
(3) how the definition of a 'forest' in the Kyoto Protocol does not adequately accommodate notions of emissions loss through forest degradation (Totten et al. 2003);
(4) whether sufficient 'carbon value' would flow to local beneficiaries;
(5) the influence of political interests on sustainable forest management and access to forests for timber production; and
(6) whether the payment of compensation required (to provide sufficient incentive to national governments to not pursue land development policies focused on land uses such as intensive agriculture that provide higher short-term economic returns) would be financially feasible.

These are also issues that are commonly referred to in the debate about climate change policy to criticize the authenticity of avoiding deforestation and forest degradation projects and to cast doubt on whether an emission credit generated through avoiding deforestation and forest degradation is equivalent to emission reduction benefits achieved through more controllable climate change mitigation strategies such as emissions reductions through carbon sequestration as applied by the current Kyoto forestry regime.

In anticipation of a decision to include REDD+ in the post-Kyoto international climate regime and to improve understanding of REDD+ implementation, a number of countries and organizations have initiated demonstration activities to support efforts to reduce emissions from deforestation (FAO 2007). These projects aim to provide additional sources of funding for readiness of REDD+ projects and are expected to boost the likelihood of REDD project development. Examples include: the World Bank's BioCarbon Fund and Community Development Carbon Fund (Osborne and Kiker 2005; World Bank (2004); the World Bank's 'Forest Carbon Partnership Facility', established in March 2007; the Australian Government's "Global Initiative on Forests and Climate", also established in March 2007 (FAO 2007); and the Government of Norway's announcement at COP13 of its contribution of about US$800 million per year over 5 years to provide support Norwegain initiatives that reduce emissions from deforestation and degradation.

Investor Behaviour in Carbon Markets

REDD+ projects typically involve: (1) a corporate sponsor, who agrees to purchase a large proportion of the credits generated and may directly fund the project or who, by agreeing to off-take the credits, underwrites funding by another entity; (2) a development bank or aid agency which also provides funding; (3) often the national government of the host country; (4) the local community; and (5) a NGO which may provide funding or services and personnel to carry out related extension work. These types of investors in carbon markets are likely to be motivated by a mix of reasons, including the desire to profit, the desire to reduce their exposure to corporate risk arising from current or future climate-change related regulations, and the desire to

contribute to and support the broader ecosystem services and social benefits (Aune et al. 2005; Amalric 2006; Bayon et al. 2007; Coomes et al. 2008). Bayon et al. (2007) argued that investors in carbon markets look for ‘carbon’ that will give them the greatest political, public relations or ethical return for their investment.

Case Study: EBEX21 Program of Landcare Research New Zealand

A case study has been carried out of the Emissions Biodiversity Exchange Project for the 21st Century’ (EBEX21), of Landcare Research New Zealand. This case study is designed to identify ways in which constraints on the inclusion of REDD in carbon markets have been successfully addressed in the context of native forest regeneration on marginal pasture land in New Zealand. Whilst the EBEX21 scheme promotes forest and temperate woodland regeneration and not avoided deforestation or degradation per se, it does provide insights into a government policy that supports a market-based forest conservation scheme and that should be useful to policy-makers and other stakeholders concerned with REDD in tropical countries, particularly in the context of small-scale forestry. It is likely that the area of forest covered by individual REDD initiatives will be much larger than the area of afforestation covered by the EBEX21. This difference may limit the applicability of insights from the EBEX21 program to REDD projects, particularly insofar as those actions can be used to overcome problems associated with leakage.

The EBEX21 program was commenced in 2001 by Landcare Research New Zealand. Landcare Research is an independent and not-for-profit Crown Research Institute involved in research relating to the conservation of ecosystems, which was founded in 1992 from a reorganization of Government funded research in New Zealand. The objective of the EBEX21 program is to expand the regeneration of forests of endemic tree species on privately owned marginal pastures throughout New Zealand by facilitating the opportunity for landowners to achieve a financial return from forest regeneration through the sale of carbon credits (Carswell et al. 2003; Trotter et al. 2005).

There were several reasons why Landcare Research instigated the EBEX21 program. As a signatory in 1993 to the Convention on Biological Diversity, New Zealand is required to develop national strategies, plans or programs that enhance the conservation and sustainable use of its unique biodiversity. The EBEX21 program supports the pursuit of this obligation (Carswell 2006). In addition, as a ratifying party of the Kyoto Protocol (in 2002), New Zealand must, by 2012, contain its national greenhouse gas emissions to a level equivalent to what they were in 1990. Recent data suggests that this will be an increasingly difficult, considering that New Zealand national greenhouse gas emissions were estimated to be close to 22% above 1990 levels in 2006 and are projected, based on the assumption of a continuation of current government policy, to be 30% above 1990 levels by 2012 (Terry 2007). There are over one million hectares of marginal pasture land in New Zealand (Eyles 1985; Trotter et al. 2005), hence the EBEX21 program has the potential to make a substantial contribution to New Zealand’s ability to meet their Kyoto Protocol targets.

In order to be eligible to enter into the EBEX21 program, the specified land must have had less than 30% canopy cover of tree species capable of reaching at least 5 m in height as of 31 December 1989 (MAF (Ministry Of Agriculture and Forestry) 2006). This is a requirement for forest to be compliant with the specifications for carbon credits under the Kyoto Protocol. Other eligibility factors include that (1) conditions affecting the existence of communities of endemic forest species will regenerate (e.g. rainfall, distance to seed sources, altitude and evidence of woody colonization), and (2) protection of the regenerated forests by a covenant (e.g. through the Queen Elizabeth II Natural Trust or the Permanent Forest Sink Initiative (EBEX21 2006; MAF (Ministry Of Agriculture and Forestry) 2006).

To enter into the EBEX21 program, eligible landholders must sign a contract with Landcare Research, committing to undertake a number of key land management activities to an appropriate standard at their own cost. These management activities include fire prevention, weed and pest control, and the exclusion of livestock from the regenerating forest or forest. Once the landowner undertakes these activities and the land is protected from grazing and fire, pioneer shrub species such as *manuka* (*Leptospermum scoparium*) and *kanuka* (*Kunzea ericoides*) naturally populate the area and act as nurse crops for endemic tree seedlings to establish. As the tree seedlings grow, the pioneer shrub species decline. In the event that there are few or no seedlings of endemic forest trees after 5 years of nurse crop, landholders are required to plant three groups of three or four endemic tree seedlings per hectare to act as a future seed source. EBEX21 project staff estimate that on average, one hectare of forests regenerated in such a way is expected to sequester approximately three tonnes of carbon dioxide per year. Staff from the EBEX21 program provide assistance to landholders to measure and verify carbon credits to prepare them for sale (EBEX21 2006).

To facilitate the sale of carbon credits from regenerated forests, Landcare Research concurrently established the 'carbonNZero' program, which provides a number of services to organizations that would like to become certified as 'carbon neutral'. These services include tools and assistance to calculate their current carbon emissions, resources to help reduce their emissions, and facilitation of the purchase of carbon credits to offset their remaining emissions. The carbonNZero program currently includes a number of carbon neutral certified organizations, including Urgent Couriers, Mercury Energy, Braun Wheatley Partners, Youth Hostels Association, Air New Zealand, Canterbury University and River Valley (EBEX21 2004; EBEX21 2007). The carboNZero program purchases carbon credits on behalf of such companies, from landowners engaged in the EBEX21 program. The 2008 price of EBEX21 program carbon credits paid by the carboNZero program was NZD30[4] per tonne of carbon dioxide (EBEX21 2008). Of this revenue, Landcare Research retains approximately 50% for administration costs of the EBEX21 and carboNZero programs and the landowner receives the remainder (Carswell et al. 2003). Based on EBEX21 estimates that typical rates of carbon sequestration by forests regenerated under the program are close to three tonnes of carbon dioxide

[4] 1 USD = 1.7NZD (as at 18th May 2009).

per hectare per year, the average annual income to landowners paid through the EBEX21 program would be approximately NZD45/ha.

The EBEX21 program has been moderately successful in that 10 marginal pasture sites of between 500 and 1000 ha in size have been successfully included in the program since it commenced in 2001. These sites have been successfully rehabilitated and the carbon credits have been sold to participants in the CarboNZero program. The program has also been highly successful in getting carbon credit buyers to engage in the CarboNZero certification process, particularly in terms of growth of the numbers of organizations seeking certification in the 2008–2009.

Despite these achievements, a number of constraints on the further expansion of the EBEX21 program have been identified by various parties. For example, the costs of silvicultural practices required for regenerating and maintaining forests (e.g. fencing) and the costs of measuring and verifying carbon credits are high. Indeed, these costs, particularly the costs of measuring and verifying carbon credits, account for most of the administrative costs subtracted from the gross carbon price paid by the CarboNZero carbon buyers (EBEX21 2006). This is despite the efficient systems used by the EBEX21 program to assist landowners with these activities. Carswell et al. (2003) suggested that the costs of measuring and verifying carbon credits could be substantially reduced through economies of scale if larger land areas were included in the EBEX21 program, but economies of scale would probably not apply to silvicultural costs. A number of commentators have also noted that the risk that forests will not be included in post-Kyoto climate change policies remains a substantial deterrent for landowners contemplating joining the EBEX21 program (Burrows 2002; MAF (Ministry Of Agriculture and Forestry) 2006).

Discussion and Concluding Remarks

The main lesson of the EBEX21 case study is that the program offers various types of support that can help proponents of tropical forest REDD in developing countries overcome the uncertainty and technical complexity that seems to underpin most of the constraints on including REDD in carbon markets. Indeed, despite uncertainty over the post-Kyoto policy status of forests and woodlands as sources of carbon credits, the EBEX21 program provides a vehicle of certainty in that it puts in place a 'real' system wherein proponents of REDD are enabled to measure, verify, maintain, finance and sell carbon credits from their forest conservation scheme. Moreover, the EBEX21 program is an example of a successful government initiative that does not involve government directly funding woodland regeneration, but rather uses market-based instruments and institutional support to assist proponents to engage in the activity. The authors acknowledge implementation of this EBEX21 program might not be feasible in developing countries for various political, technical and economic reasons, but the scheme does serve as an interesting example of a successful government-led initiative, that can inform the design of comparable voluntary carbon market schemes that may be useful in overcoming the various challenges that were reviewed in earlier parts of this paper concerning implementing REDD policy in developing countries.

The EBEX21 program informs proponents of REDD about carbon trading opportunities and acts as an advocate for the use of market-based instruments to enhance and foster ecosystem services. This is an important form of support in that it helps to address uncertainty about carbon trading and provides a reliable source of technical guidance that proponents can use to learn more about some of the more complicated aspects of carbon trading and continuing forest conservation. The technical support offered by a scheme such as EBEX21 on practices associated with permanence and stakeholder engagement, would be highly useful to help proponents of REDD ensure satisfactory management of carbon forestry schemes.

The technical support offered by the EBEX21 program to landowners to help measure and verify carbon, could also help address those constraints related to measuring effectively carbon emissions saved through REDD. EBEX21 addresses these technical concerns for New Zealand tree growers by providing a set of protocols for measurement and verification, expert technical support and carbon measurement tools that help landowners properly measure carbon credits, and a service wherein EBEX21 program staff act as the verifiers of carbon credit measurements. It is notable, however, that whilst the EBEX21 model provides some useful insights for carbon measurement in REDD projects, the costs of undertaking such activities remains restrictive. Ideally, government support would be targeted at reducing the cost burden of measuring and verifying carbon sequestration in REDD projects, through providing incentives to project developers and beneficiaries.

Similar to EBEX21 as a useful model that could help enable REDD to be included in carbon markets, there are a number of recently established schemes that warrant further consideration. One example is the Forest Carbon Partnership Facility of the World Bank. This facility was established in March 2007 to provide capacity building funds of US$100 million, to be invested in strengthening the capacities of 20 tropical and sub-tropical nations so that they are ready to access a future system of financial incentives for REDD. The facility is also piloting transactions funds of US$200 million to establish pilot carbon finance transactions for about five 'ready' countries before the post-2012 Kyoto regime is devised. The REDD-ready activities envisaged include training in the use of the IPCC's 'Good Practice Guidance' and providing other assistance for assessing and monitoring forest carbon, setting a REDD baseline country-wide, and developing strategies for reducing carbon emissions from deforestation and forest degradation (FAO 2008). It is evident from the objectives that developing countries which are more REDD-ready are more likely to be among the five ready countries which will attract the pilot finance.

These initiatives differ from EBEX21 model in that they tend to be international and driven by development agencies, rather than the national government of the country in which the REDD scheme is located. Having the national government as the key advocate has a number of advantages, including the integration of local control and local knowledge. The EBEX21 is also a model that can be adopted at the national-level, and is not constrained by the selection of ready applicants by international organizations. Equity and effectiveness of programs similar to EBEX21 by national governments in tropical developing countries might also be adversely influenced by weak governance systems.

The additional problem remains of how the costs of REDD (measurement, verification, management and compensation payments) can be sufficiently minimized—particularly in the case of smaller-sized REDD projects—and how REDD can become a cost-competitive source of carbon credits compared to other methods of GHG sequestration or emissions reduction. That noted, there are other ecosystem service and social benefits of REDD that could potentially justify higher costs, particularly in the case of over-the-counter markets in which investors are motivated by 'the story' of the investment as much as they are by the direct financial rates of return.

Various issues not highlighted by this analysis are important considerations for future research. For example, a number of REDD projects have recently commenced, and detailed case analysis of these programs could provide further useful information about the nature of constraints to including REDD in carbon markets and how those constraints can be addressed effectively. Examples of these new REDD projects include: (1) a project by Merrill Lynch, that is raising equity for a large-scale avoided deforestation project in Aceh Indonesia (Zwick 2008); (2) a project by Canopy Capital, a private equity firm which purchased the rights to 16% of profit from proceeds generated from environmental service payments from 371,000 ha of rainforest reserve in Guyana (Butler 2008a); and (3) a project by New Forests, which entered into an agreement with the PNG Government to establish a forestry conservation-based carbon finance project (Butler 2008b). There is also the opportunity to develop robust financial models that evaluate the comparative costs and investment returns of various sizes and types of tropical forest REDD.

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